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EXAMINER

WERNER, BRIAN P

ART UNIT PAPER NUMBER

2621

DATE MAILED: 02/11/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/516,581

Applicant(s)

DELAROSA ET AL.

Examiner

Brian P. Werner

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 November 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. This office action is responsive to the amendment and remarks received on November 18, 2003. Claims 1-39 are now pending.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-9, 11, 13-22, 24, 26-35, 37 and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by David (US 6,068,954 A).

Regarding claims 1, 2, 9, 11, 13, 14, 15, 22, 24 and 26, David discloses a method and apparatus (i.e., figures 6-8) for measuring the registration between two integrated circuit layers ("wafer" layers at column 7, line 2), on residing over the other ("ascertain whether the latent image of the alignment pattern is aligned relative to a substrate over which it is received" at column 5, line 52), comprising:

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an optical imaging system ("optical scanning devices" at column 6, line 60) generating an image (figure 2) of a field of the two integrated circuit layers, each of the layers having a respective visible feature in the image (as depicted in figure 2, the lower layer has alignment mark 22 and the upper layer has mark 12; both marks are visible to the camera as both are picked up in the image; this overall claimed step is depicted at figure 6, numeral 32);

means for digitizing the image and processing the digitized image (the image processing module of figure 8, numeral 42, which is equivalent to the applicant's disclosed structure of an image processing module at applicant's figure 2, numeral 148) to determine a relative location of the visible feature of one layer relative to the feature of the other layer ("translational error" at column 5, line 20, as depicted in figure 4; this overall claimed step is depicted as figure 6, numeral 34); and

means for determining if the relative location is within acceptable design limits for the integrated circuit layers (again, the image processing module of figure 8, numeral 42, which is equivalent to the applicant's disclosed structure of an image processing module at applicant's figure 2, numeral 148; the inspection processor of David's numeral 42 compares the positional deviation with "desired tolerances" at column 5, line 15; this claimed step is depicted at figure 6, numeral 36).

Regarding claims 3-5 and 16-18, David anticipates the determination of "translational" errors from an image of the alignment marks as described at column 5, line 20, and as depicted in figures 4 and 5. David discloses how the relative translational misalignments between the two alignment marks are measured and

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compared with "desired tolerances" at column 5, line 15. The translational misalignments are with respect to the "X and Y directions" at column 3, line 44. Given that the David's is computer implemented with all of the processing done by the computer, then David necessarily determines the x and y image coordinates of both the upper and lower marks as called for by claims 3,4,16 and 17, and further determines their relative displacements with respect to one another (i.e., "translational error" at column 5, line 20) as called for by claims 5 and 18.

Regarding claims 6, 8, 19 and 21, David discloses acceptable design limits ("alignment tolerances" at column 4, line 11).

Regarding claims 7 and 20, David calculates an offset value (i.e., the "translational error" at column 5, line 20).

David anticipates newly added claims 27-35, 37 and 39 as applied to the claims above.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 12, 25 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of David (US 6,068,954 A) and Worster et al. (US 5,479,252 A).

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While David requires a scanner "capable of examining the alignment patterns in measuring the desired parameters" (i.e., at column 6, line 61), David does not teach a microscope and a video camera.

Worster discloses a system that captures images of a wafer, where the image scanner comprises a microscope and a video camera ("microscope" and "camera" at column 10, lines 4-5; figure 1, the camera is designated at numeral 219, and the microscope by the optics in front of the camera including numerals 223 and 205).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the camera/microscope of Worster as the image pickup device required by David to capture images "with an accuracy of a few microns" (Worster, column 6, line 3) without "the use of a microscope eyepieces that would result in undesirable proximity of the operator to the wafer ... that may result in contamination" (Worster, column 10, line 6).

6. Claims 10, 23 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of David (US 6,068,954 A) and Seiler et al. (US 4,766,311 A).

While David requires a scanner "capable of examining the alignment patterns in measuring the desired parameters" (i.e., at column 6, line 61), David does not teach a scanning electron microscope.

Seiler discloses a system that captures images of wafers, where the image scanner is a scanning electron microscope ("scanning electron microscopes" at column 2, line 60).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the electron microscope of Seiler as the image pickup device required by David to capture images that are "highly precise" (Seiler, column 1, line 10).

Response to Arguments

7. Each of the remarks and/or arguments filed with the aforementioned amendment have been considered:

The David Reference

Summary of Applicant's Remarks: David fails to suggest measuring the registration between two integrated circuit layers by generating an image of a field of said two layers, each layer having a respective visible feature in the image (response page 9, second paragraph down).

Examiner's Response: Disagreed. David measures the registration between two integrated circuit layers ("align various layers during processing" at column 2, line 64; "ascertain whether the latent image of the alignment patten is aligned within desired alignment tolerances" at column 4, line 10). David does this by generating an image of a field of said two layers ("optical scanning devices which are capable of examining the alignment patterns in measuring the desired parameters described above" at column 6, line 60). Each of David's layers has a respective visible feature in the image ("reference mark 22" at column 3, line 40 is formed on an underlying layer; i.e., "reference mark is shown at 22 which is disposed within a previously-provided underlying layer" at column

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2, line 66; an "alignment pattern 12" at column 3, line 41 is formed on an overlying layer; i.e., "a layer of undeveloped photoresist 24 is formed over substrate 16 and exposed to processing conditions effective to form an image of an alignment pattern 12 ... over wafer scribe area 20" at column 3, line 1). Again, once marks 12 and 22 are formed on their respective layers, "layer 24 is inspected relative to an underlying substrate structure, which in this example comprises alignment reference mark 22" at column 3, line 7. Given that David uses "optical scanning devices which are capable of examining the alignment patterns in measuring the desired parameters described above" as described at column 6, line 60, the alignment marks 12 and 22 are both visible in the same image. A depiction of the images acquired by David's optical scanning devices is presented at figures 2-5. David meets all of the claimed limitations.

Summary of Applicant's Remarks: David fails to teach "an imaging system" (response page 9, second paragraph down).

Examiner's Response: Disagreed. First, David suggests an "automated inspection using conventional metrology tools" at column 3, line 13. However, David is more specific about the image capture system at column 6, line 60, where he states, "the input devices can also include various optical scanning devices which are capable of examining the alignment patterns in measuring the desired parameters described above". Optical scanning devices acquire "images"; and in particular, the images depicted in David's figures 2-5. Further, David even "displays" the images at column 6, line 54. David meets all of the claimed requirements.

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Summary of Applicant's Remarks: David does not teach generating an image of a field of the two integrated circuit layers".

Examiner's Response: Disagreed. David does exactly that, as described immediately above.

Summary of Applicant's Remarks: David is silent about digitizing the image and processing the image to determine relative location of the visible feature on one layer relative to the other.

Examiner's Response: The "digitizing" is met by David by an implicit, if not inherent disclosure. That is, David captures an image overlying patterns (e.g., as in David's figure 3 or 4) using optical scanning techniques (i.e., column 6, line 60). An optical image is not digital; rather, it is completely real, and completely analog. David then describes how the image data is input into the computer depicted in figures 7 and 8, for processing to determine relative locations of the alignment marks (i.e., figure 8, numerals 42 and 46). One skilled in the art would recognize that David's computer is not an optical computer. Rather, David's computer is a rather standard digital computer; one that processes data digitally. Therefore, somewhere there must be a digitization of the optical image produced by the optical scanner. This is simply axiomatic to one skill in the art.

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The David and Worster Combination

Summary of Applicant's Remarks: At response page 10, second to bottom paragraph, the applicant provides the criteria for a prima facie case for obviousness alone with case law citation.

Examiner's Response: The examiner is completely familiar with the criteria for a prima facie case for obviousness; and the case has been met by the previous advanced rejections.

Summary of Applicant's Remarks/Examiner's response: In response to applicant's arguments against the references individually at response page 11, first two paragraphs, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Summary of Applicant's Remarks: Worster teaches against using an optical system that comprises a microscope and a video camera.

Examiner's Response: Disagreed. This is exactly what Worster teaches. First, it is noted that claim 12 requires, "wherein said optical system comprises a microscope and a video camera". Claim 25 requires the equivalent thereof. These broadly recited limitations are not only well know, but are not further limited to any specific configuration of a microscope and camera, let alone any specific types of microscope or camera.

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Second, the terms “optical”, “camera” and “microscope” are defined as follows (The American Heritage® Dictionary of the English Language, Third Edition copyright © 1992 by Houghton Mifflin Company. Electronic version licensed from INSO Corporation; further reproduction and distribution restricted in accordance with the Copyright Law of the United States. All rights reserved.) :

Optical: Of or relating to optics.

Camera: An apparatus for taking photographs.

Microscope: An optical instrument that uses a lens or a combination of lenses to produce magnified images of small objects.

David certainly discloses the use of an optical system for acquiring images. In fact, David even explicitly uses the term “optical” at column 6, line 60. Now, regarding the Worster reference and the requirements of claims 12 and 25, Worster teaches, in the same field of endeavor of David (i.e., semiconductor inspection), a camera for capturing an image at figure 2, numeral 219. Worster even uses the word camera, at column 10, line 4, where he states “camera 219”. Worster acquires an image of the semiconductor using the camera coupled to a microscope at figure 2, numeral 223. Numeral 223 is a turret of microscope lenses that are selectable to provide different amounts of magnification. Worster describes the lenses as providing different levels of “magnification” at column 8, lines 5-10. Thus, Worster meets all of the requirements of claims 12 and 25; particularly with regard to the broadly recited claim elements, as interpreted in accordance with their plain meanings.

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Summary of Applicant's Remarks: Worster teaches against the use of an optical system as contemplated by the claimed invention (response page 12, first paragraph).

Examiner's Response: The claimed invention contemplates, by virtue of the words used in the claims, a "camera" and a "microscope". This is exactly what Worster teaches.

The David and Seiler Combination

Summary of Applicant's Remarks/Examiner's response: In response to applicant's arguments against the references individually at response page 12, bottom two paragraphs, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Summary of Applicant's Remarks: David teaches the use of conventional metrology tools, and not an "imaging system" as in the claimed invention.

Examiner's Response: Claims 10 and 23 require a scanning electron microscope. Such a microscope is very convention in the field of semiconductor inspection. While David does not explicitly teach a scanning electron microscope, David does not preclude or teach away from its use. The Seiler references teaches the use of a scanning electron microscope for purposes of inspections, and the rejection is provided with proper motivation for making the David and Seiler combination.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Werner whose telephone number is 703-306-3037. The examiner can normally be reached on M-F, 8:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on 703-305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Brian Werner
Primary Examiner
Art Unit 2621
February 3, 2004



BRIAN WERNER
PRIMARY EXAMINER